IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	K. Miyano et al.	: Art Unit:
Serial No.:	To Be Assigned	: Examiner:
Filed:	Herewith	:
FOR:	METHOD OF CALCULATING EXCITING COEFFICIENTS FOR CIRCULAR ARRAY ANTENNA AND RADIO UNIT UTILIZING THE SAME	:

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

S I R :

Prior to examination, please amend the above-identified application as follows:

IN THE CLAIMS:

Please cancel claims 1-25 and add new claims 26-50.

26. (Newly Added) A method of providing an antenna pattern, said method comprising the steps of:

selecting at least one of an arbitrary beam width and an arbitrary beam direction for said pattern; and

providing said antenna pattern according to said at least one of said selected arbitrary beam width and arbitrary beam direction.

27. (Newly Added) A method of providing an antenna pattern according to claim 26, wherein both said arbitrary beam width and said arbitrary beam direction are selected for said pattern and said antenna pattern is provided according to said arbitrary beam width and arbitrary beam direction.

28. (Newly Added) The method of claim 26, wherein at least one of the arbitrary beam direction and the arbitray beam width for said pattern are determined from incoming radio waves estimated in relation to traffic conditions.

29. (Newly Added) The method of claim 26, wherein at least one of the beam direction and the beam width for said pattern are selected from preset values.

30. (Newly Added) A method of providing an antenna pattern according to claim 26, further comprising the steps of:

calculating integral limits for estimating excitation coefficients of a linear array based on said selected beam width and beam direction;

calculating said excitation coefficients;

transforming said excitation coefficients into excitation coefficients of a circular array;

wherein said antenna pattern is provided based upon said excitation coefficients of said circular array.

31. (Newly Added) A method of providing an antenna pattern according to claim 30, wherein said excitation coefficients are calculated by a Fourier series.

32. (Newly Added) A receiving system for use with a circular antenna, said receiving system comprising:

a calculator for establishing an antenna pattern of said circular antenna based upon at least one of an arbitrary beam width and an arbitrary beam direction; and

a pathway for effecting signals obtained by use of said antenna based on said established antenna pattern..

33. (Newly Added) The receiver of claim 32, further comprising:

a receive frequency converter for converting the radio frequency signals received by the circular array antenna to either intermediate frequency signals or baseband signals,

wherein either the intermediate frequency signals or the baseband signals are multiplied by coefficients calculated by said calculator, respectively, to form resultant signals, and

wherein the resultant signals are combined.

34. (Newly Added) A receiver comprising:

a circular antenna comprising a plurality of antenna elements disposed circularly;

a coefficient calculator for calculating excitation coefficients for the circular array antenna based on a beam direction and a beamwidth of a desired antenna pattern;

a receive frequency converter for converting radio frequency signals received by the circular array antenna to either intermediate frequency signals or baseband signals; and

a plurality of receive beam formers, each of the receive beam formers for respectively multiplying either the intermediate frequency signals or the baseband signals by the coefficients calculated by the coefficient calculator and combining resultant signals,

wherein the receive beam formers are coupled in parallel to the receive frequency converter,

wherein the coefficient calculator is commonly coupled to the receive beam formers, and

wherein the coefficient calculator comprises means for setting the number of beams which is equal to the number of receive beam formers.

35. (Newly Added) A receiver comprising:

a circular array antenna comprising a plurality of antenna elements disposed circularly;

a coefficient calculator for calculating excitation coefficients for the circular array antenna based on a beam direction and a beamwidth of a desired antenna pattern;

a plurality of receive frequency converters, each of the receive frequency converters for converting radio frequency signals received by the circular array antenna to either intermediate frequency signals or baseband signals; and

a plurality of receive beam formers, each of the receive beam formers for respectively multiplying either the intermediate frequency signals or the baseband signals by the coefficients calculated by the coefficient calculator and combining resultant signals,

wherein the receive frequency converter and the receive beam former are coupled in parallel to the circular array antenna,

wherein the coefficient calculator is coupled to the receive beam formers, and

wherein the coefficient calculator comprises means for setting the number of beams which is equal to the number of receive beam formers.

36. (Newly Added) The receiver of claim 34, wherein the coefficient calculator comprises means for setting an antenna power of each of the beams.

37. (Newly Added) The receiver of claim 36, wherein the coefficient calculator comprises means for setting an antenna power of each of the beams.

38. (Newly Added) The receiver of claim 33, further comprising:

an arrival direction estimating unit for estimating arrival directions of incoming radio waves in relation to traffic conditions; and

a statistical processor for statistically processing outputs of the arrival direction estimating unit to determine the beam direction and the beamwidth.

39. (Newly Added) The receiver of claim 33, further comprising:

a storage unit for previously storing the beam direction and the beamwidth,

wherein the beam direction and the beamwidth are read from the storage unit.

40. (Newly Added) A transmitting system for use with

a circular antenna, said transmitting system comprising:;

a calculator for establishing an antenna pattern of said circular antenna based upon at least one of an argbitrary beam width and an arbitrary beam direction; and

a pathway for effecting signals to be propagated by use of said antenna based on said established antenna pattern.

41. (Newly Added) The transmitter of claim 40, further comprising:

a transmit beam former for splitting a transmit signal into signals, the number of which is the same as the number of antenna elements of the circular array antenna, and respectively multiplying the signals by the coefficients thereby to form transmit beams,

transmit frequency converter for converting the transmit beams of the transmit beam former to either intermediate frequency signals or baseband signals,

wherein the circular array antenna is excited by either the intermediate frequency signals or the baseband signals of the transmit frequency converter.

42. (Newly Added) A transmitter comprising:

a circular array antenna comprising a plurality of antenna elements disposed circularly;

a coefficient calculator for calculating excitation coefficients for the circular array antenna based on a beam direction and a beamwidth of a desired antenna pattern;

a plurality of transmit beam formers, each of the transmit beam formers for splitting a transmit signal into signals, the number of which is the same as the number of antenna elements of the circular array antenna, and respectively multiplying the signals by the coefficients thereby to form transmit beams; and

a transmit frequency converter for converting the transmit beams of each of the transmit beam formers to either intermediate frequency signals or baseband signals,

wherein the transmit beam formers are coupled in parallel to the transmit frequency converter,

wherein the coefficient calculator is commonly coupled to the transmit beam formers, and

wherein the coefficient calculator comprises means for setting the number of beams which is equal to the number of transmit beam formers.

43. (Newly Added) A transmitter comprising:

a circular array antenna comprising a plurality of antenna elements disposed circularly;

a coefficient calculator for calculating excitation coefficients for the circular array antenna based on a beam direction and a beamwidth of a desired antenna pattern;

a plurality of transmit beam formers, each of the transmit beam formers for splitting a transmit signal into signals, the number of which is the same as the number of antenna elements of the circular array antenna, and respectively multiplying the signals by the coefficients thereby to form transmit beams; and

a plurality of transmit frequency converters, each of the transmit frequency converters for converting the transmit beams of the corresponding transmit beam former to either intermediate frequency signals or baseband signals,

wherein the combinations of the transmit frequency converter and the transmit beam former are coupled in parallel to the circular array antenna,

wherein the coefficient calculator is commonly coupled to the transmit beam formers, and

wherein the coefficient calculator comprises means for setting the number of beams which is equal to the number of transmit beam formers.

44. (Newly Added) The transmitter of claim 42, wherein the coefficient calculator comprises means for setting an antenna power of each of the beams.

45. (Newly Added) The transmitter of claim 39, wherein the coefficient calculator comprises means for setting an antenna power of each of the beams.

46. (Newly Added) The transmitter of claim 40, further comprising:

an arrival direction estimating unit for estimating arrival directions of incoming radio waves in relation to traffic conditions; and

a statistical processor for statistically processing outputs of the arrival direction estimating unit to determine the beam direction and the beamwidth.

47. (Newly Added) The transmitter of claim 40, further comprising:

a storage unit for previously storing the beam direction and the beamwidth,

wherein the beam direction and the beamwidth are read from the storage unit.

48. (Newly Added) A radio unit for use with

a circular antenna having a plurality of antenna elements disposed circularly, said radio unit comprising:

a calculator for establishing an antenna pattern of said circular antenna based on at least one of an arbitrary beam direction and an arbitrary beam width of a desired antenna pattern;

a receive frequency converter for converting radio frequency signals received by the circular antenna to either intermediate frequency signals or baseband signals;

a receive beam former for respectively multiplying either the intermediate frequency signals or the baseband signals by coefficients calculated by the coefficient calculator and combining resultant signals;

a transmit beam former for splitting a transmit signal into signals, the number of which is the same as the number of antenna elements of the circular array antenna, and respectively multiplying the signals by the coefficients thereby to form transmit beams; and

a transmit frequency converter for converting the transmit beams of the transmit beam former to either intermediate frequency signals or baseband signals,

wherein the calculator is commonly coupled to the receive beam former and the transmit beam former.

49.(Newly Added) The radio unit of claim 47, further comprising:

an arrival direction estimating unit for estimating arrival directions of incoming radio waves in relation to traffic conditions; and

a statistical processor for statistically processing outputs of the arrival direction estimating unit to determine the beam direction and the beamwidth.

50. (Newly Added) The radio unit of claim 48, further comprising:

a storage unit for previously storing the beam direction and the beamwidth,

wherein the beam direction and the beamwidth are read from the storage unit.

Respectfully Submitted,

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Kathleen Libby

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

CLAIMS:

Claims 1-25 have been cancelled.

Claims 26-50 have been added.